Intelligent/cognitive Agents Applications for Pervasive Computing

Using COGNET Human Modeling Capabilities for Pervasive Applications

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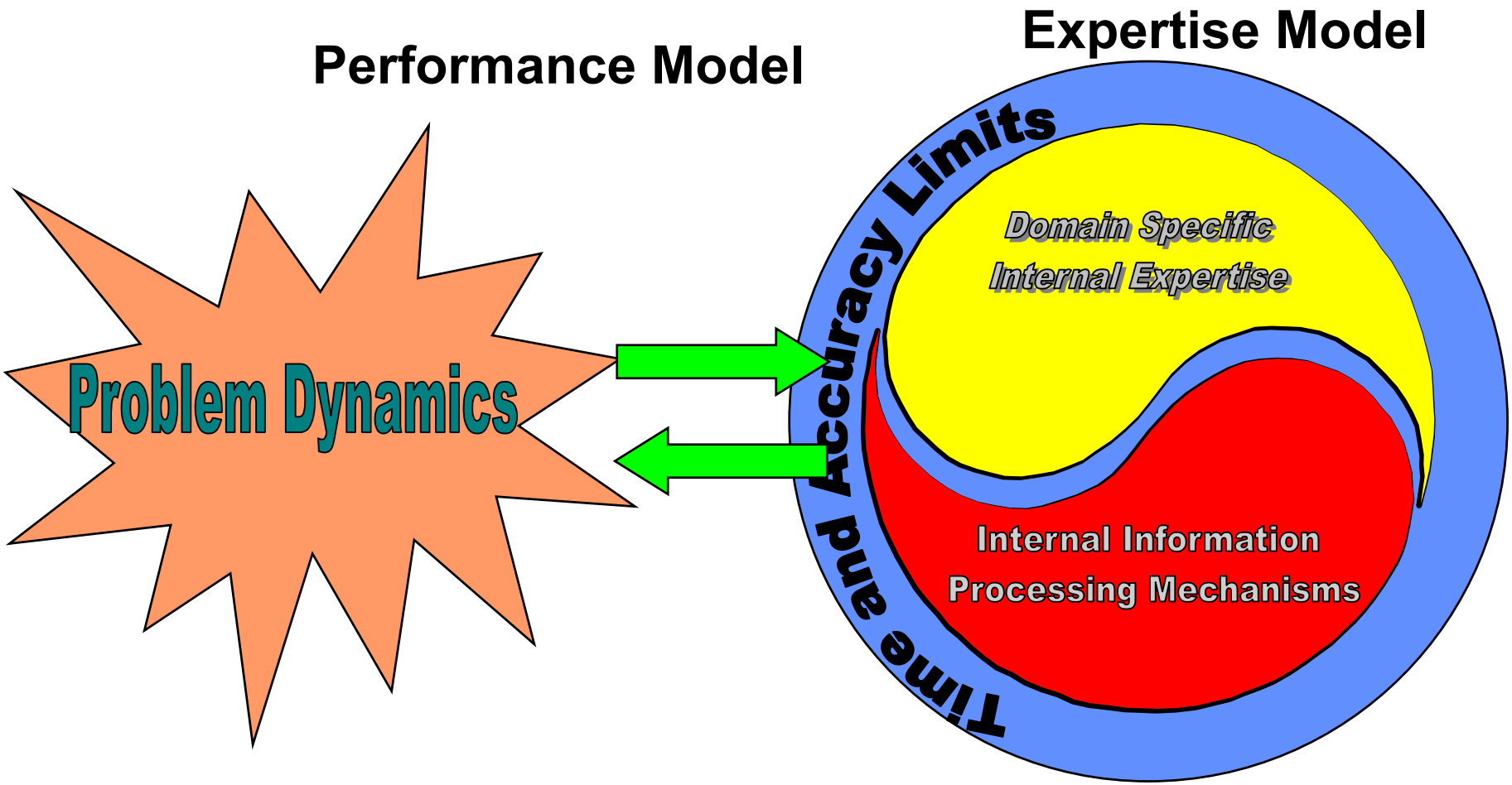
Goals of COGNET Research…

- Enable Cognitive Task Analysis of Human Problem-Solving in:
  - Real-Time Systems and Problems
  - Multi-Tasking Jobs and Environments
- Create Model that can:
  - Describe human information processing in both cognitive and behavioral terms
  - Generate predictions of future behavior
  - Explain its decisions
- Driven by Application Concerns, such as in:
  - Simulations that predict (expert) human performance
  - Embedded models
  - Intelligent Assistants and Agents

COGNET/iGEN™ Framework

- COGNET -- openly published, theory-based methodology to capture internal expertise
- CEL Description Language
  - Formalism for representing domain-specific expertise
- BATON -- underlying executable cognitive architecture
  - to emulate internal processing mechanisms
  - highly portable and embeddable
  - extendable
  - C++ and Python Bindings
  - incorporated into iGEN™
- iGEN™ -- product that supports authoring, debugging, visualization and application of executable COGNET models

What is a COGNET Model?



What does it consists of?

- Declarative knowledge -- how to think about the world
  - multi-panel blackboard, with semantic links
- Procedural knowledge chunks -- how to do things
  - compiled goal hierarchies
  - read and modify declarative blackboard
- Perceptual demons -- how to make sense of what you see & hear
  - self-activating encoding rules
- Action knowledge -- how to manipulate things
- Meta-Knowledge -- attention flow
  - Knowledge-applicability contexts (task triggers)
  - Situational priority
  - Metacognition

What can you do with cognitive agents?

- Simulation
- Prototyping
- Training and Documentation
- Virtual Tutors
- Intelligent Human-Computer Interface and automation

Training/Tutoring

- **Training**
  - ***how can you predict what knowledge trainees need to perform the correct actions?***
  - ***how can you diagnose what knowledge is missing when trainee actions are incorrect?***
- **Virtual Tutors**
  - ***what the user should do next?***
  - ***why should he/she do it?***
  - ***when should he/she do it?***
  - ***how should it be done?***
  - ***explanation across PC devices***

Human-Computer Interfaces

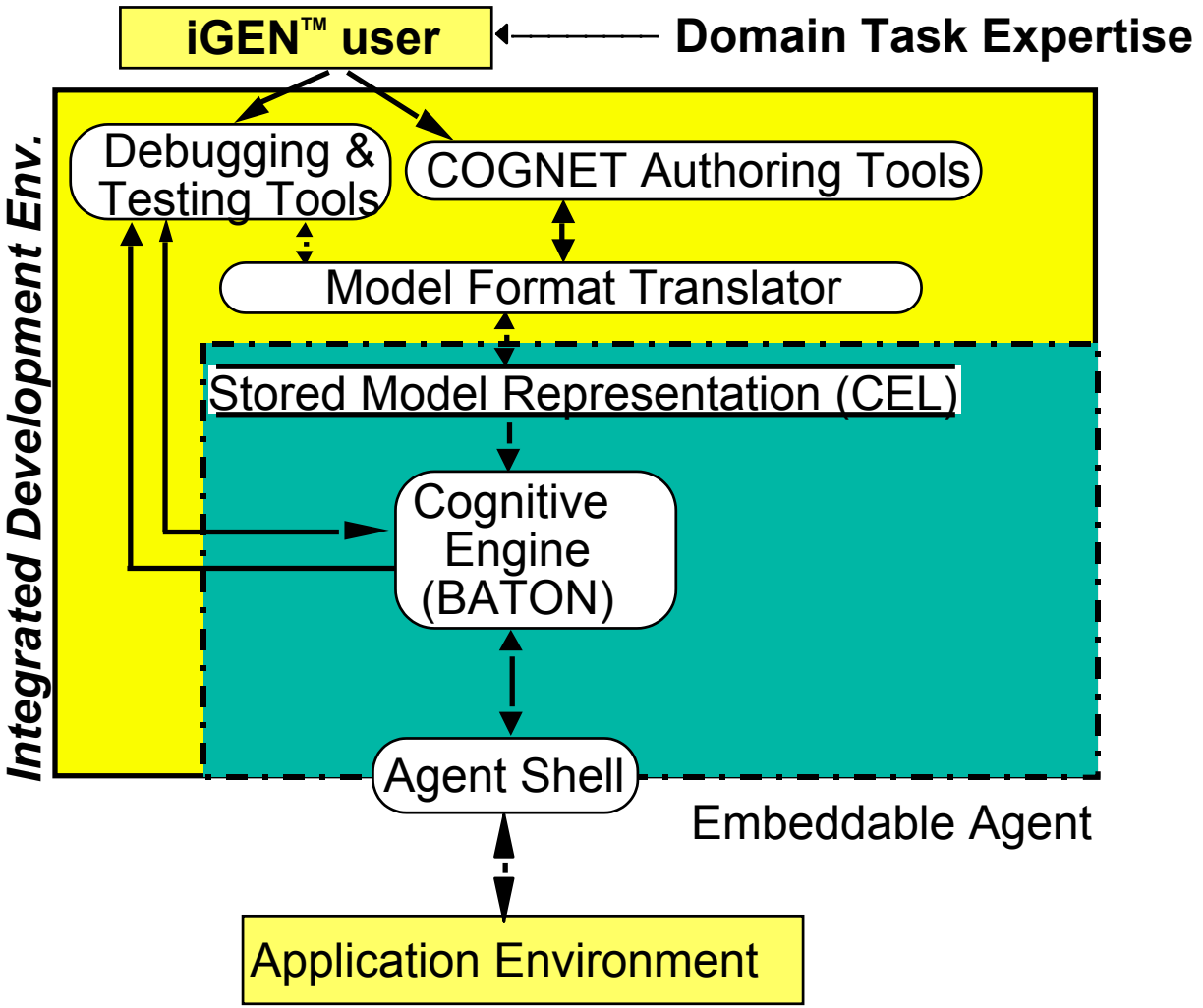
- **HCI's**
  - *what information is needed at what times in the process?*
  - *what interaction dynamics should be built into the interface?*
  - *how can the HCI know what the user is doing?*
  - *how can the HCI help the user perform work tasks?*
  - *how does this differ for novices, experts? Different personalities ?*
- **System Evolution Planning**
  - *what knowledge of old systems can/should be transferred to new one?*
  - *how can new system usage be engineered when there are no existing users?*
  - *what are the cognitive requirements of the new system, given the problems experienced (and successes achieved) with the old?*

Simulation

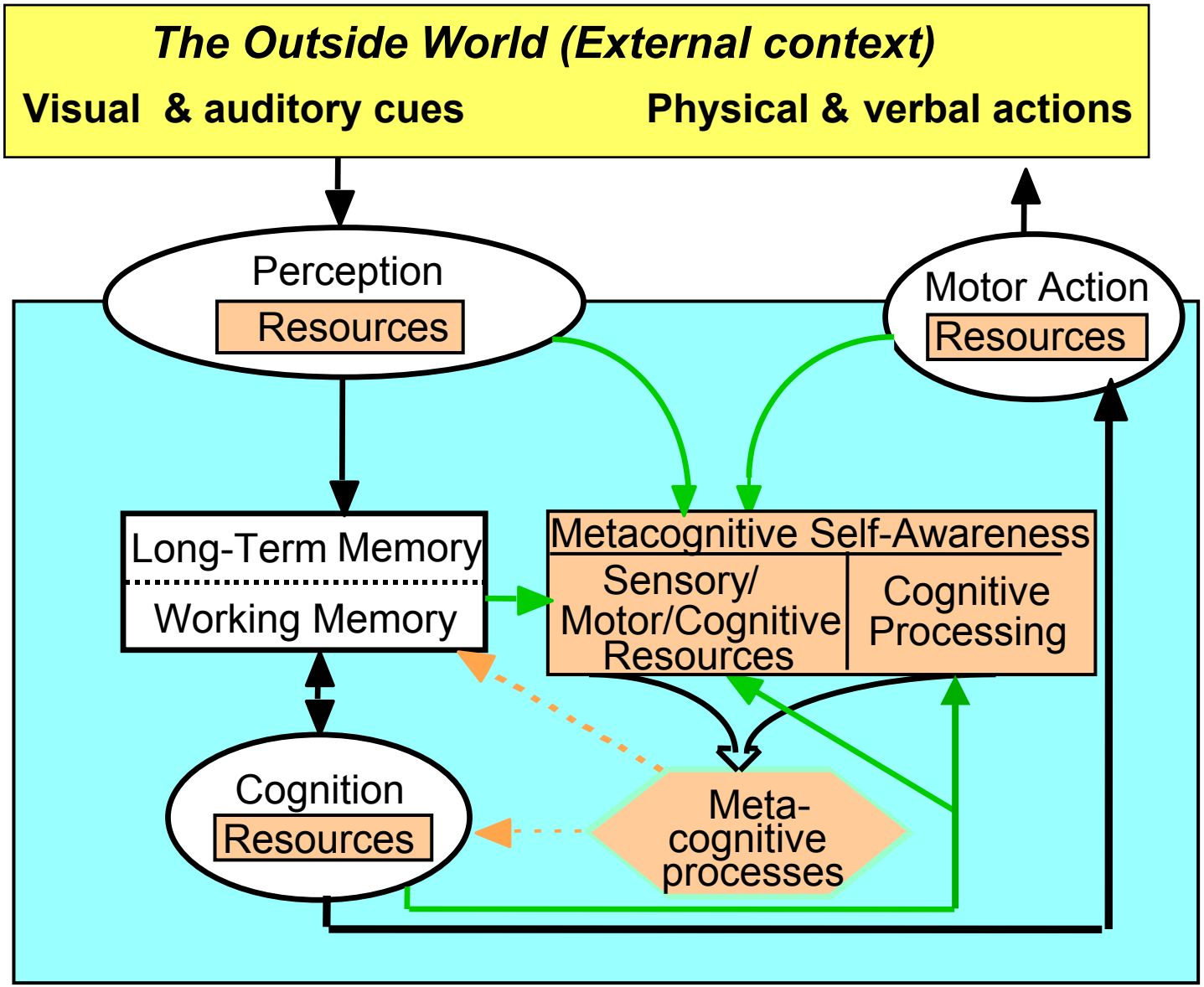
how can we get simulated entitites to behave realistically?

- **Sensory/Motor abilities**
- **Performance Models / Micro-models**
- **Memory moderators**
- **Metacognition / planning / failures**
- **Individual differences**
- **Representational scalability**
- ***Learning***

The Development Workbench (iGEN™)



BATON Architecture



CGR: Cell Graphical Representation

- Visual language
- Context driven editing
- Only correct syntax
- Configurable for specific domains

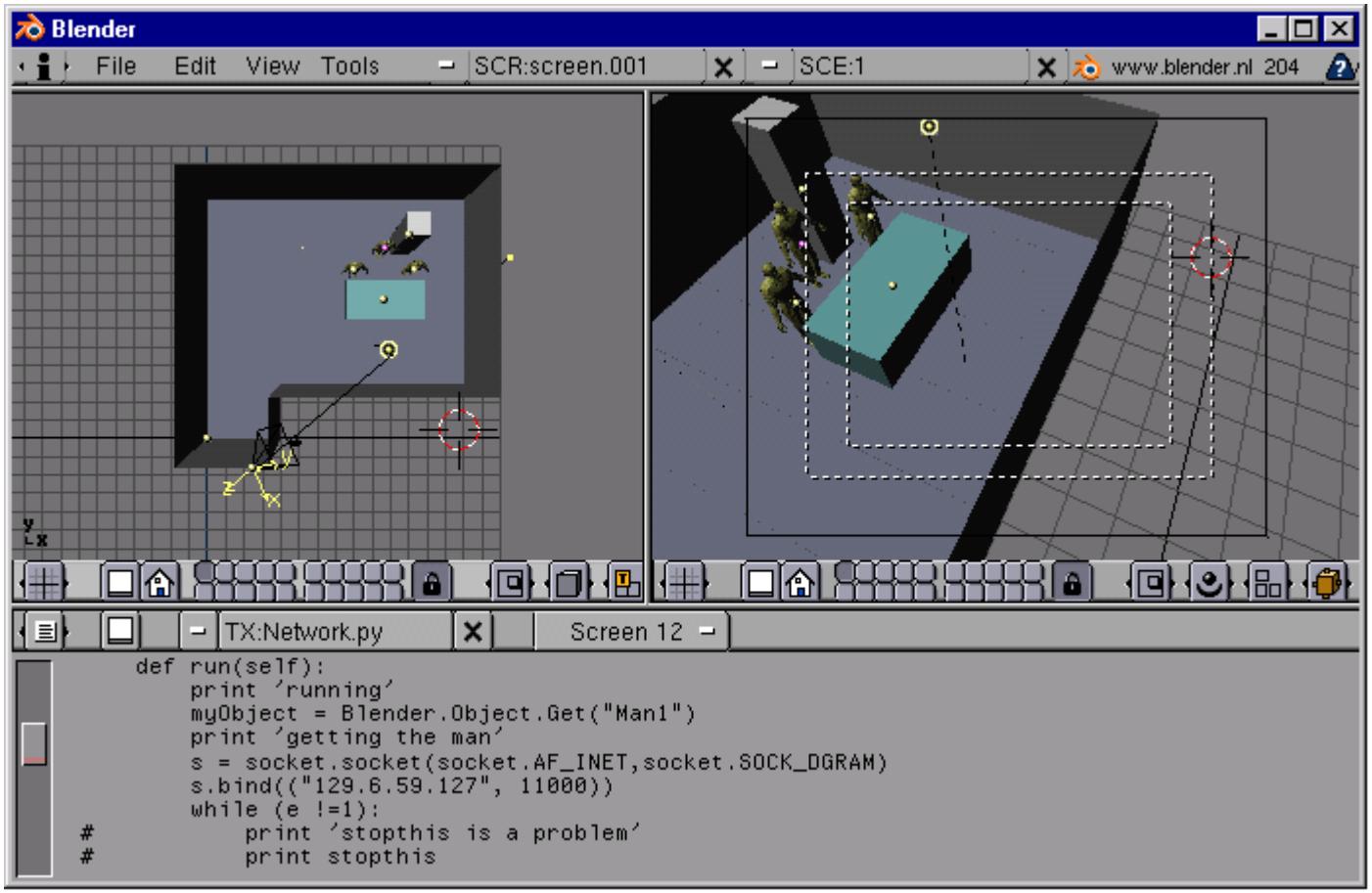
EXiST (NIST) + COGNET

- **Developed in the frame of the NIST Aroma Project**
- **NIST EX**perimental **S**imulation **T**ool (EXiST)
  - **Will help define use cases, requirements and measurements for Pervasive Computing**
  - **Simulator built around a real-time event engine**
  - **Uses measurements from experimentation to feed the simulation**
  - **Allows measurements to be combined to form more complex metrics**
  - **Will allow for the validification of conceptual models for pervasive computing such as NIST Layered Pervasive Computing (LPC) conceptual model**
  - **Modular Design**
  - **Developed in Python (simple development and integration of new modules in Python)**

EXiST (NIST) + COGNET

- Using Cognitive Agents in Pervasive Computing
  - **to assess PC:**
    - **They can emulate the human interactions during simulations and therefore help building viable business models of technologies**
  - **to create smarter Smart Spaces:**
    - **Expert Systems can help users using a Pervasive Computing environment**
    - **And learn from their interactions**

Embedding BATON



Questions and Discussion

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